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NOTES ON THE MORPHOLOGY AND FAMILY RELATIONSHIPS OF LESTONIIDAE (HEMIPTERA: HETEROPTERA)

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Abstract.—Some hitherto undescribed features of the small Australian family Lestoniidae are discussed. These features include aspects of the male genitalia and the pregenital abdomen. The family is related to Plataspidae, but others' suggestions that it is also related to Scutelleridae are not confirmed.

Key Words: Hemiptera, Heteroptera, Pentatomoidea, Lestoniidae, Plataspidae, Scutelleridae, Morphology

Lestoniidae, a family of Australian Pentatomoidea, contains two species, *Lestonia haustorifera* China and *L. grossi* McDonald. Its family-level relationships and many aspects of its morphology have been ably described by China (1955) and McDonald (1969, 1970). In particular, China (1955), in describing the genus *Lestonia*, created for it a new subfamily in the Plataspidae; he later (China and Miller 1959) raised it to family rank. McDonald (1970) concluded Lestoniidae is indeed close to Plataspidae, and more distantly related to Scutelleridae.

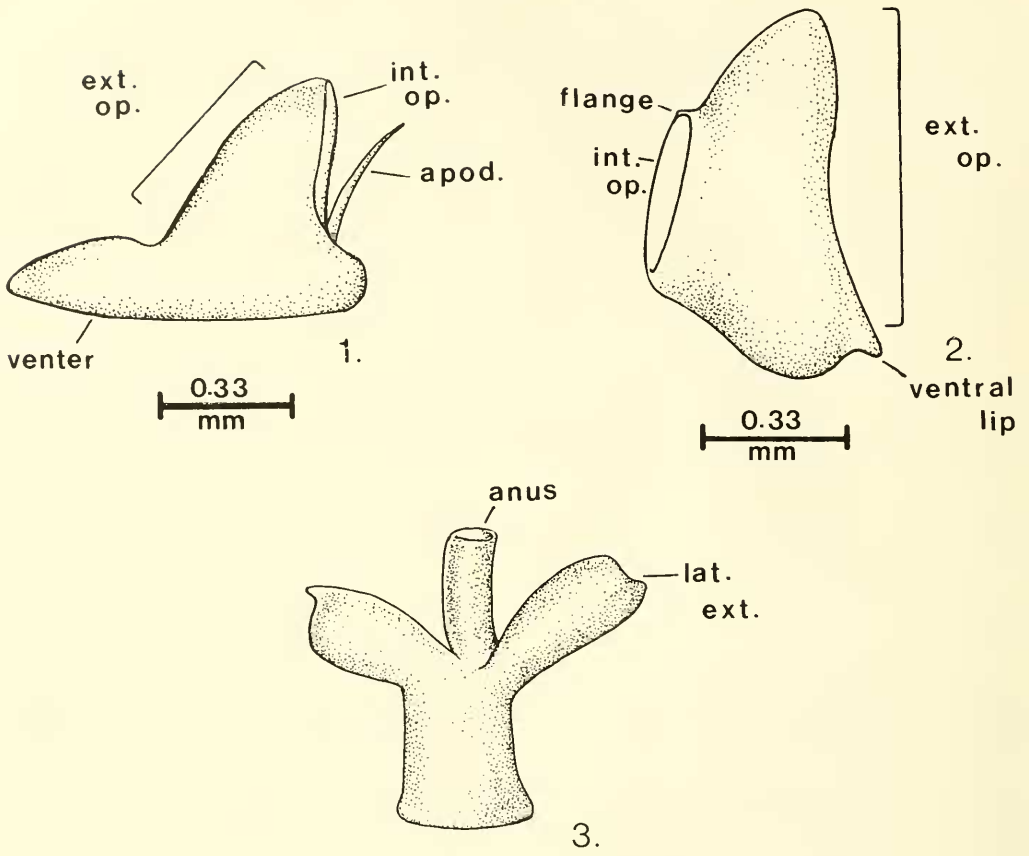
McDonald's (1969, 1970) illustrations of the male's genital capsule suggested to me a possible affinity of the family to a group of "primitive" pentatomoids centered on Cydnidae. Plataspidae is a member of this group, and perhaps Scutelleridae is related to it. Accordingly, when G. F. Gross generously sent me several specimens of *L. haustorifera*, I looked at several morphological features not mentioned in earlier work, to confirm or deny these affinities. This paper is therefore meant to complement the fine ones of China and McDonald, not to replace them.

Methods

Genital capsules of male specimens, already soft from having been stored in alcohol, were very lightly treated with cold dilute KOH.

Results

Abdomen.—Tergites 3–7 fused, inter-tergal sutures visible only in lateral third of segment, except second-third visible across entire tergum. Eighth paratergites of female completely fused on midline, extending posteriorly. No connexivum or inner laterotergites. Sternites 3–7 fused, intersternal sutures clearly visible only laterally, very faintly visible medially; except third-fourth visible across sternum, as slight internal ridge. Second sternite very narrow medially, and with rounded median apodeme extending anteriorly. Sixth sternite on either side of midline with round "gland-like" area in female; this smaller, comma-shaped, in male. McDonald (1970) describes three such pairs on sternites 5–7 (largest on 6) in *L. grossi*, but does not mention (1969) them in *L. haustorifera*.



Figs. 1–3. *Lestonia haustorifera*, male. 1. eighth segment (lateral view). 2. genital capsule (lateral view). 3. proctiger (dorsal view), apod. = apodeme, ext. op. = external opening, int. op. = internal opening, lat. ext. = lateral extension.

Trichobothria and spiracles.—Two pairs of trichobothria, on sternites 3–7. Trichobothria side by side, of same size, both lateral (ectal) to spiracle (*contra* McDonald [1970]). Spiracles more medial than in most Pentatomoidea. All spiracles towards anterior edge of small, pale brown, oval area; these areas not shown by McDonald (1970) for *L. haustorifera*, but shown by him (1969) for *L. grossi*.

Coxal combs.—None.

Metathoracic wing strigil.—None.

Male's eighth segment (Fig. 1).—Interior opening anterior, but venter somewhat expanded anteriorly, below internal opening. Stout apodeme arising external to segment, from venter of internal opening. Venter greatly expanded posteriorly, as a "scoop" covering nearly entire venter of genital capsule; that part of scoop expanded (not withdrawn into insect's body) of rougher texture than concealed part. Without remnant of spiracle.

Male's genital capsule (Fig. 2; also McDonald 1969, fig. 4, and McDonald 1970, fig. 2[1]).—External opening posterior; internal opening anterior and slightly dorsal, its edge produced as a slight flange. Ventral rim folded in parallel to ventral wall and apparently fused to it; ventral rim flared slightly as a ventral lip; ventral rim not expanded. Dorsal rim only somewhat expanded, it and

[1] In fig. 4 of McDonald (1969), "ventral margin" should be "dorsal margin."

lateral rim folded in perpendicular to their walls, meeting ventral rim smoothly. Cuplike sclerite and median projection tightly fused, this composite structure rising slightly above level of external opening; slight space intervening between composite structure and ventral rim infolding. Cuplike sclerite with well sclerotized lateral "arms." Without suspensory apodemes; suspensory plates of basal plate apparatus apparently articulating directly with arms of cuplike sclerite.

Male's paramere (see McDonald 1970, fig. 5).—Insertions displaced so tips lie dorsally, not ventrally (capsule's external opening directly posterior). Paramere tip blunt, with very small recurved point. Shaft straight, ending in long apodemelike extension opposite the flattened attachment apodeme.

Male's proctiger (Fig. 3).—Dorsum lightly sclerotized basally, sclerotization extending a little way laterally, but not ventrally. Pair lateral extensions arising subapically; these membranous, irregular in shape. Proctiger not modified for protection of aedeagus (as in "higher" Pentatomoidea).

Discussion

Family status of Lestoniidae.—The family has several features unusual in its superfamily, and a few that may be unique: the apodeme of the male's eighth segment; the lack of a suspensory apodeme on the cuplike sclerite of the male's genital capsule; the membranous appendages of the male's proctiger; the dorsal orientation of the parameres; the fusion of the female's eighth paratergites; the placement of both trichobothria lateral to the spiracle; (perhaps) the oval patches accompanying the spiracles, and the latter's more medial position; and the slight flange of the internal opening of the male's genital capsule. *Lestonia haustorifera* is unusual also in having a cupressaceous host plant, *Callitris preissi* (McDonald 1970, G. F. Gross, pers. commun. 1991), a plant whose genus is restricted to Australia and New Guinea (Willis 1973). Although several pentatomoids feed on members of the Cupressaceae, this is not a common host family. The host plant of *L. grossi* is unknown.

This combination of apomorphies fully confirms China and Miller's (1959) raising of Lestoniinae to family rank, and McDonald's (1969, 1970) acceptance thereof.

Family relationships of Lestoniidae.—As McDonald (1970) notes, the structure of the aedeagus, and the lack of flanges on the spermatheca and of a dilation of the spermathecal duct, exclude Lestoniidae from Pentatomidae and the families related to it. The spermathecal features are, he says, like those of Cydnidae, and one (the lack of flanges) like some Scutelleridae (but see below). The enlarged scutellum (China 1955) is also characteristic of Scutelleridae, but this occurs in several other groups (including a few pentatomids) as well.

The lestoniid aedeagus resembles that of Plataspidae (McDonald 1970). In addition, both families are members of a complex of pentatomoid groups (Cydnidae [sensu Dolling 1981, plus Parastrachiinae], Cyrtocoridae, Canopidae, Megarididae) defined by several features, especially of the genital capsule (Schaefer, in preparation). More particularly, Lestoniidae resembles Plataspidae in more of these capsule characteristics than it does any other member of the complex. However, Plataspidae and a few others of the complex have an exceptionally broad infolding of the capsule's dorsal rim; the infolding of Lestoniidae and the remainder is less broad. Lestoniidae may, therefore, link these two subgroups.

The duct of the spermatheca is simple (i.e., unswollen) in some members of the Plataspidae's subgroup, and in Lestoniidae. However, only in Lestoniidae and Megarididae (not a member of that subgroup) does the spermathecal bulb lack flanges (McDonald 1970, 1979). (McDonald's 1970 statement that Cydnidae also lack flanges is in error; see Pendergrast 1957 and McDonald 1966.) The simple spermathecal duct is probably plesiomorphic. Because the spermathecal bulbs of most relatives of the Pentatomo-

idea—as well as of most pentatomoids—have flanges (Pendergrast 1957), their absence here in Lestoniidae and Megarididae is probably apomorphic, but not necessarily autapomorphic.

Some members of this complex have a stridulitrum on the hind wing (Schaefer 1981), and others do not; Plataspidae does, but Lestoniidae does not. Many members also have coxal combs (presumably for cleaning the antennae); neither Lestoniidae nor Plataspidae have them. The amount of tergal and sternal fusion in Lestoniidae is like that of other pentatomoids. Lestoniidae lacks inner laterotergites, as do some other members of the complex. More unusual is the lack of a connexivum in Lestoniidae, a fact doubtless secondary and perhaps correlated with the small size of the insect and the great abdomen-covering development of its scutellum.

These results confirm China's (1955) and McDonald's (1970) conclusion that Plataspidae and Lestoniidae are phylogenetically close. A more comprehensive cladistic analysis is needed to show if they are sister groups.

McDonald (1970) believes Lestoniidae is distantly related to Scutelleridae. His evidence is the lack of spermathecal flanges in these families. However, Scutelleridae and Cydnidae do indeed have spermathecal flanges (Pendergrast 1957, Kumar 1965, McDonald 1966). Thus no feature allies Lestoniidae and Scutelleridae.

At least one scutellerid, the scutellerine *Chrysocoris purpureus* Westwood, shares some characteristics with the complex of Pentatomoidea to which Lestoniidae belongs (Schaefer, unpublished). However, I believe these similarities to be convergent, and they are not possessed by other scutellerids. Nevertheless, the relationship of Scutelleridae (or of some of its members) to this complex of Pentatomoidea, deserves further study.

Finally, the position of both trichobothria lateral to the spiracle places Lestoniidae in Ruckes's (1961) Group 6. Other members of this Group are Pentatomidae: Pentatominae and Discocephalinae, to neither of which is Lestoniidae related.

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